HEAVY-DUTY ENGINE OIL CLASSIFICATION PANEL

OF

ASTM D02.B0.02

October 8, 2003

DoubleTree Hotel – O'Hare, Rosemont, IL

ACTION ITEMS

1. Request Section 7 develop a single test for 30 and 90 cycle shear stability results. Sub-comm. B

MINUTES

1.0 Call to Order

1.1 Chairman Jim McGeehan called the meeting to order at 7:57 a.m. on October 8, 2003, in the Lincoln Room of the DoubleTree Hotel in Rosemont, Illinois. There were 19 members present or represented and approximately 20 guests present. The attendance list is shown as Attachment 2.

2.0 Agenda

2.1 The published agenda (Attachment 1) was reviewed and agreed upon.

2.2 Chairman McGeehan emphasized again that we need to keep PC-10 on time and threatened to bring out the "big guns" if needed (Attachment 3).

3.0 Previous Meeting Minutes

3.1 The minutes of the June 17, 2003 meeting were approved as distributed and posted, via a motion from Lew Williams, seconded by Abdul Cassim.

4.0 Membership

4.1 Heather Kelly of International Truck and Engine will replace Frank Bondarowicz since Frank has moved on to a well deserved retirement. Frank and his contributions were honored at a dinner the previous evening.

5.0 "B" Ballot Status

5.1 Tom Franklin reviewed the proposed ballot to remove top ring weight loss as a pass/fail parameter from the M-11 EGR test in D4485. See Attachment 4. There were no objections to the proposal. The ballot has not been issued yet, but should do so soon.

5.2 Tom also reviewed a proposed D4485 change to drop Tin as a pass/fail parameter in the HTCBT for CH-4 and CI-4. See Attachment 5. Tin would become a report only parameter. There were no objections.

6.0 Shear Stability

6.1 Considerable discussion arose regarding the 30 and 90 cycle shear results that are now needed. Eventually, Dave Stehouwer moved and Steve Kennedy seconded a motion for "B" to ask Section 7 to develop a single test to obtain both 30 cycle and 90 cycle shear stability results. The motion passed by unanimous voice vote.

7.0 PC-10

7.1 Greg Shank reported that the EMA still want PC-10 oils in place by mid-2006.

8.0 PC-10 Seals

8.1 Robert French of Dupont gave a presentation on their Vamac material (Attachment 6) and answered questions about the material. Greg Shank agreed to provide Vamac G specifications (Attachment 7). Robert Stockwell was interested to know if Vamac was part of as SAE seal specification standard…no one knew. Greg Shank moved and Lew Williams seconded that Vamac be included in the elastomer compatibility requirements for PC-10. The motion passed via unanimous voice vote.

8.2 Jim Wells solicited members for Beck Grinfield's PC-10 Elastomer Compatibility Task Force. Nine volunteers signed up.

9.0 ISM

9.1 Warren Totten gave a presentation on developing a Cummins ISM based test to replace the M-11 EGR and the M-11 HST tests. See Attachment 8. Lowell Norris wanted to know if the oils planned to be used now would work for PC-10 or would it be better to wait and run later with PC-10 matrix oil included.

10.0 Next Meeting

10.1 The next meeting was tentatively set for Nov. 6, 2003, in Chicago.

11.0 Adjournment

11.1 The meeting was adjourned at 9:03 a.m. and transformed into a DEOAP meeting.

Submitted by,

Jim Wells
Secretary to the HDEOCP

ATTACHMENT 1

Final Agenda
ASTMSECTION D.02.BO.02
HEAVY-DUTY ENGINE OIL CLASSIFICATION PANELS

DoubleTree Hotel
5460 N River Road, Rosemont, Il
Tel# 847-292-9100 or Direct line 847-292-3519
October 8th 2003
8:00 am-9:15 pm (Coffee at 7:30 am)

Chairman/ Secretary: **Jim Mc Geehan/Jim Wells**
Purpose: **PC-10**

Desired Outcomes: **PC-10 timing and completed ballots**

Note all presentations will be made from the computer to Focus projector. Bring discs or CD's for minutes.
Also need money for the rooms and other room items

TOPIC	PROCESS	WHO	TIME
Agenda Review	• Desired Outcomes & Agenda	Group	8:00-8:05
Minutes Approval	• June 17th 2003	Group	8:05-8:10
Membership	• Changes: Additions • Chairman's comments on membership and PC-10 timing	Jim Mc Geehan	8:10-8:20
Sub. D02.BO Ballot items	• Cummins M11 EGR ballot • Vote • Test Method D6594 (HTCBT)	Tom Franklin	8:20-8:45
PC-10	• EMA position on need and time for PC-10	Greg Shank	8:45-9:15
PC-10 Seals	• Vamac seal: background	Roger French	9:15-9:30
NCDT meeting	• We agreed at last DEOAP meeting this meeting would move to NCDT or a DEOAP meeting		9:30-3:00

Alexander, West
ChevronTexaco Global Lubricants
100 Chevron Way
Richmond, CA 94802
(510) 242-2246, FAX (510) 242-3758
alex@chevrontexaco.com

Belay, Mesfin
Detroit Diesel Corp.
13400 W. Outer Dr., K15
Detroit, MI 48239-4001
313-592-5970, FAX 313-592-5952
mesfin.belay@detroitdiesel.com

Bondarowicz, Frank
International Truck and Engine Corp.
10400 West North Ave., Dept 555
Melrose Park, IL 60160
708-865-4030, FAX 708-865-4229
frank.bondarowicz@nav-international.c

Carlson, Susan
EMA
2 N. LaSalle St.
Suite 2200
Chicago, IL 60602
312-269-8405, FAX
scarlson@emamail.org

Cassim, Abdul H.
Caterpillar Inc.
Bldg. H2000 - Dk 13
RT#29 @ Old Galena Rd.
P.O. Box 4000
Mossville, IL 61552-0610
309-578-9096, FAX 309-578-3653
cassim_abdul_h@cat.com

Chao, Kenneth K.
John Deere
P.O. Box 8000
Waterloo, IA 50704-8000
319-292-8459, FAX 319-292-8441
chaokennethk@jdcorp.deere.com

Ferrick, Kevin
API
1220 L St. NW
Washington, DC 20005
(202) 682-8233, FAX (202) 962-4739
ferrick@api.org

Fetterman, G. Pat
Infineum USA, LP
P.O. Box 735
Linden, NJ 07036
908-474-3099, FAX 908-474-3363
pat.fetterman@infineum.com

Finn, Rick
Infineum USA LP
P.O. Box 735
Linden, NJ 07036
908-474-7208, FAX
rick.finn@infineum.com

Franklin, Thomas M.
PerkinElmer
5404 Bandera Rd.
San Antonio, TX 78238
(210) 647-9446, FAX (210) 523-4607
tom.franklin@perkinelmer.com

French, Robert S.
Dupont Automotive
950 Stephenson Highway
P.O Box 7013
Troy, MI 48007-7013
248-583-5838, FAX 248-583-8121
robert.s.french@usa.dupont.com

Gault, Roger
EMA
2 North LaSalle St.
Suite 2200
Chicago, IL 60602
312-827-8742, FAX
rgault@emamail.org

Herzog, Steven
RohMax USA Inc
723 Electronic Drive
Horsham, PA 19044-2228
(215) 706-5817, FAX (215) 706-5801
steven.herzog@degussa.com

Kelly, Heather J.
International Truck & Engine Corp.
10400 West North Ave.
Melrose Park, IL 60160
708-865-3788, FAX 708-865-4229
heather.kelly@nav-international.com

Kennedy, Steve
ExxonMobil R&E
Billingsport Rd.
Paulsboro, NJ 08066
856-224-2432, FAX 856-224-3613
steven.kennedy@exxonmobil.com

Klein, Rick
Oronite
143 Cady Center, #226
Northville, MI 48167
(248) 380-0625, FAX (248) 380-0287
rmkl@chevrontexaco.com

Kleiser, Bill
Chevron Oronite Technology
100 Chevron Way
Richmond, CA 94802
510-242-3027, FAX 510-242-3173
wmkl@chevrontexaco.com

Laroo, Chris
US EPA
2000 Traverswood Dr.
Ann Arbor, MI 48188
734-214-4937, FAX
laroo.chris@epa.gov

Lynskey, Mike
Castrol
9300 Pulaski Highway
Baltimore, MD 21220
410-682-9484, FAX 410-682-9408
lynskem@bp.com

Mazzamaro, Glenn
CIBA Specialty Chemicals
540 White Plains Rd.
Tarrytown, NY 10591
914-785-4221, FAX 914-785-4249
glenn.mazzamaro@cibasc.com

McGeehan, Jim
Chevron Global Lubricants
100 Chevron Way
Richmond, CA 94802
510-242-2268, FAX 510-242-3758
jiam@chevrontexaco.com

Norris, Lowell
ExxonMobil
17402 Mareton Ln
Spring, TX 77379
, FAX
lowell.t.norris@exxonmobil.com

Place, William E.
Oronite
1315 E. Michigan Ave., #194
Saline, MI 48176
(734) 222-0890, FAX (734) 222-4065
wepl@chevrontexaco.com

Pridemore, Dan
Ethyl
2000 Town Center, Suite 1750
Southfield, MI 48075
248-350-0640, FAX 248-350-0025
dan_pridemore@ethyl.com

Quinn, Michael J.
Caterpillar Inc.
Bldg. H2000 - Dk 13
RT#29 @ Old Galena Rd.
P.O. Box 4000
Mossville, IL 61552-0610
309-578-4790, FAX 309-578-3653
Quinn_michael_j@cat.com

Rees, Mark
The Lubrizol Corp.
29400 Lakeland Blvd.
Wickliffe, OH 44092
(440) 347-5385, FAX
mree@lubrizol.com

Runkle Jr., William A.
Valvoline Company
LA-GN
P.O. Box 14000
Lexington, KY 40512-4000
(859) 357-7686, FAX (859) 357-7610
wrunkle@ashland.com

Selby, Ted
Savant, Inc.
4800 James Savage Rd.
Midland, MI 48642
(989) 496-2301, FAX (989) 496-3438
tselby@savantgroup.com

Shank, Greg L.
Mack Trucks, Inc.
13302 Pennsylvania Ave.
Hagerstown, MD 21742-2693
301-790-5817, FAX 301-790-5815
greg.shank@macktrucks.com

Smith, David B.
API
3 Tanglewood Ct.
Ridgefield, CT 06877
203-894-8242, FAX
dbsmith727@ad.com

Stehouwer, David M.
Stehouwer Technical Services
5034 Countess Drive
Columbus, IN 47203
812-378-9825, FAX
dmstehouwer@core.com

Stockwell, Robert T.
General Motors Corporation
GM Powertrain Engineering Center
Mail Code 483-730-322
823 Joslyn Rd.
Pontiac, MI 48340
810-492-2268, FAX 810-575-2732
robert.stockwell@gm.com

Totten, Warren A.
Cummins Engine Co.
1900 McKinley Ave.
MC 50183
Columbus, Indiana 47201
812-377-3429, FAX
warren.a.totten@cummins.com

Urbanak, Matthew
Shell Global Solutions US
Westhollow Technology Center
(L-109C)
P.O. Box 1380
Houston, Texas 77251-1380
281-544-9227, FAX 281-544-8150
matthew.urbanak@shell.com

Wells, James M.
Southwest Research Institute
PO Drawer 28510
San Antonio, TX 78228-0510
(210) 522-5918, FAX (210) 523-6919
james.wells@swri.org

Weyenberg, Thomas R.
Lubrizol
29400 Lakeland Blvd.
Wickliffe, OH 44092-2298
440-347-1301, FAX 440-347-1733
trwe@lubrizol.com

Williams, Lewis A.
The Lubrizol Corporation
29400 Lakeland Blvd.
Wickliffe, OH 44092
440-347-1111, FAX 440-944-8112
lawm@lubrizol.com

Zalar, John
ASTM TMC
6555 Penn Ave.
Pittsburgh, PA 15206
(412) 365-1005, FAX (412) 365-1047
jlz@astmtmc.cmu.edu

Zechiel, Scott
Detroit Diesel Inc.
13400 W. Outer Drive
Detroit, MI 48239-4001
313-592-7995, FAX 313-592-5906
scott.zechiel@detroitdiesel.com

PC-10: “On Time or Else”

J A McGeehan

ATTACHMENT 3

SUBCOMMITTEE D02.B0 BALLOT ITEM

To: ASTM D02.B0 Members

From: Lyle Bowman, B0.9 Chairman

Subject: Revision of D 4485

WK#: WK 2771

Rationale: Passing both the Cummins M11 EGR and Mack T-10 test methods are two of the specified requirements in the CI-4 Engine Oil Category. The Cummins surveillance panel recommended changing the measurement of top ring wear in the M11 EGR test from a required maximum value to a Report only item. To ensure that piston ring wear in Cummins engines is still adequately protected, Cummins has subsequently determined that a passing T-10 test, which includes the measurement of piston ring wear, is a suitable substitute.

In Table 3, in the CI-4 Category, for the M11 EGR test methods,

	One-test	Two-tests	Three-tests
M11 EGR[Y]			
~~Average top ring weight loss, mg, max~~	~~175~~	~~186~~	~~191~~
Average top ring weight loss, mg	Report	Report	Report

4.1.9.3 The M11 EGR heavy-duty diesel engine test is used to evaluate oil performance with respect to valve train ~~and piston ring~~ wear, sludge deposits, and oil filter plugging in an exhaust gas recirculation environment.

In TABLE A9.1, Outlier Test Determination Values

~~M11 EGR TRWL~~	~~22.9~~	(est. of std. dev.)

SUBCOMMITTEE D02.B0 BALLOT ITEM

To: ASTM D02.B0 Members

From: Lyle Bowman, B0.9 Chairman

Subject: Revision of D 4485

WK#: WK 2846

Rationale: Test Method D 6594 (HTCBT) is one of the test methods incorporated in the CH-4 and CI-4 Engine Oil Categories in Specification D 4485. Currently, there is a HTCBT tin wear loss measurement passing limit in the two categories. Due to the inability to develop a meaningful precision statement for tin wear loss (the tin wear loss results with the reference oils have been essentially zero), and the ASTM mandatory requirement that all test results shall have a precision statement, the HTCBT Surveillance Panel has recommended removing the tin wear loss result as a test method requirement and replacing it with a Report only item.

In Table 3, under the CH-4 Category,

D 6594	Used Oil Elemental Concentration mg/kg increase, ~~max~~	Tin ~~50~~ Report

In Table 3, under the CI-4 Category,

D 6594	Tin, mg/kg increase, ~~max~~	~~50~~ Report

4.1.8.10 Test Method D 6594 operated at 135°C, a High Temperature Corrosion Bench Test (HTCBT), has been shown to predict the corrosion of engine oil-lubricated copper and lead~~, or tin~~-containing components used in diesel engines.

4.1.9.12 Test Method D 6594 operated at 135°C, a high temperature corrosion bench test (HTCBT), has been shown to predict corrosion of engine oil-lubricated copper and lead~~, or tin~~-containing components used in diesel engines.

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Heavy Duty Engine Oil Classification Panel

Vamac® Ethylene/Acrylic (AEM) Elastomers in the Transportation Industry

Rob French
DuPont Automotive
October 8, 2003

Vamac® Elastomer Performance

Wide service temperature range at reasonable cost

⇨ - 40 °C to 175 °C

Good resistance to engine oils, fluids, ozone and UV

High vibration damping

Excellent compression set and CSR

Vamac® Ethylene / Acrylic "AEM"

ASTM D2000 Line Call Out

Heat Resistance

Vamac® is rated as Type " E " ➨ 175°C

Continuous use up to 165°C

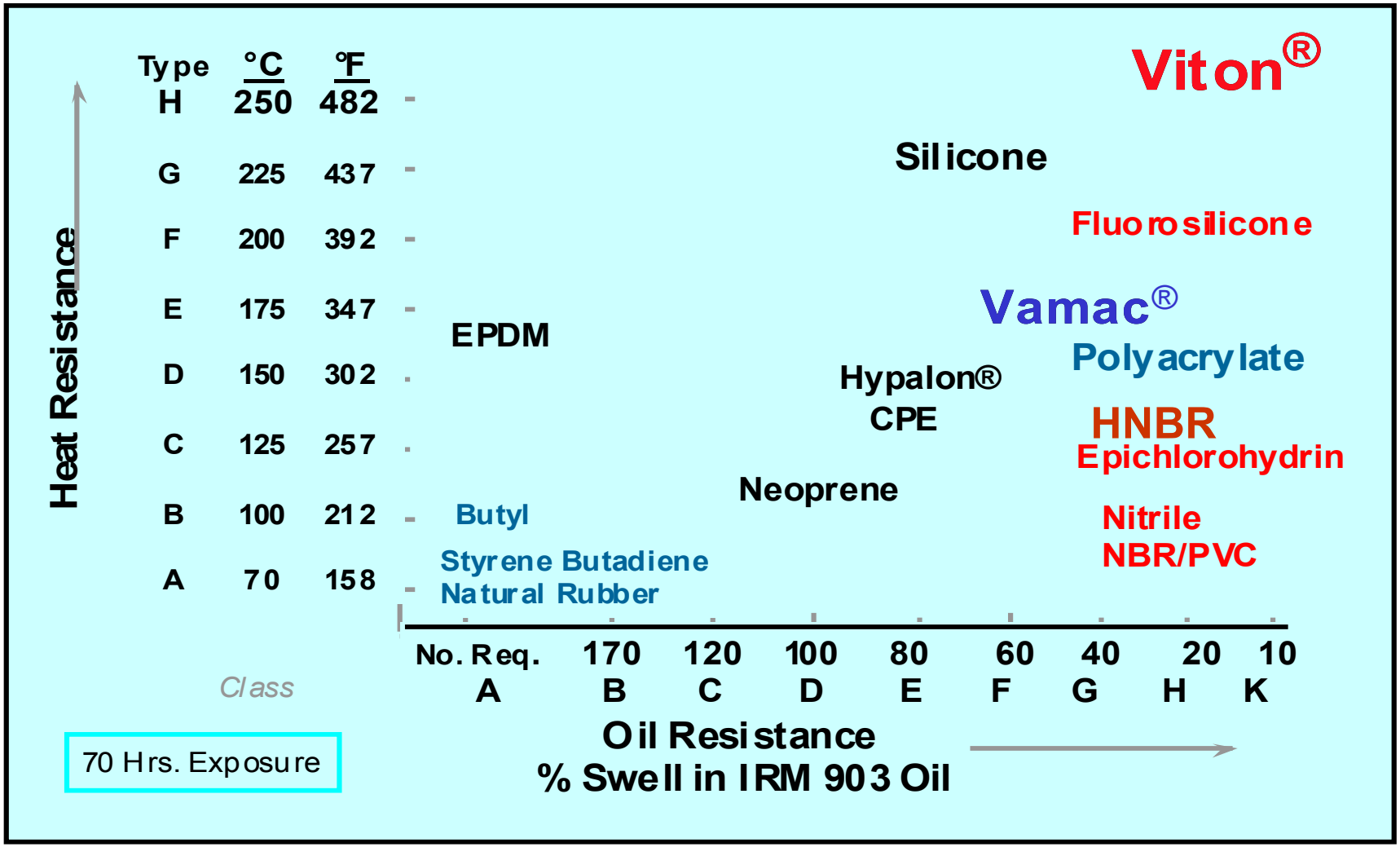
Fluid Resistance

Vamac® is rated as

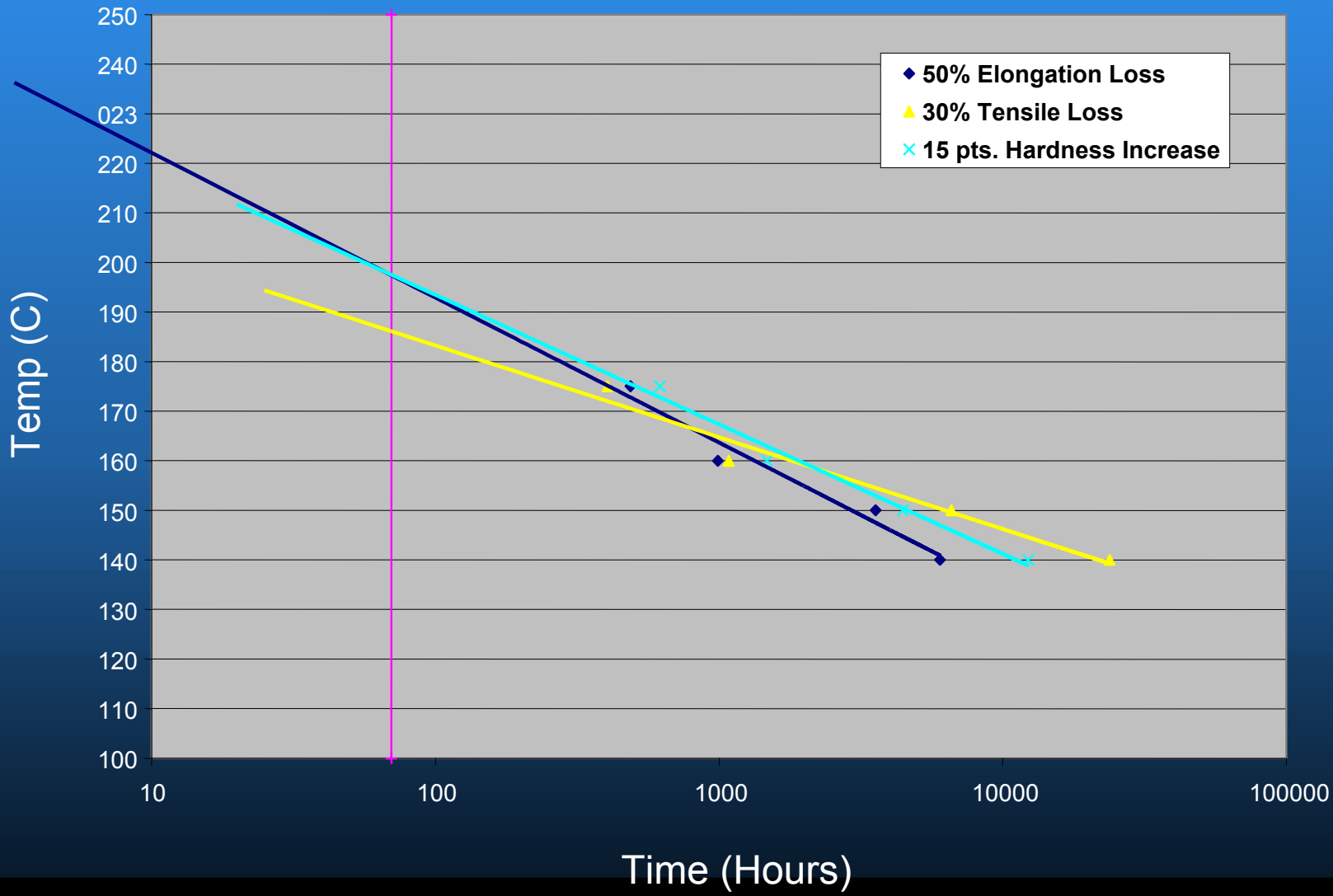
Class " F " for G & D Grades (60% Max)

Class " G " for GLS Grade (40% Max)

Heat & Oil Resistance of Elastomers
ASTM D2000 / SAE J200

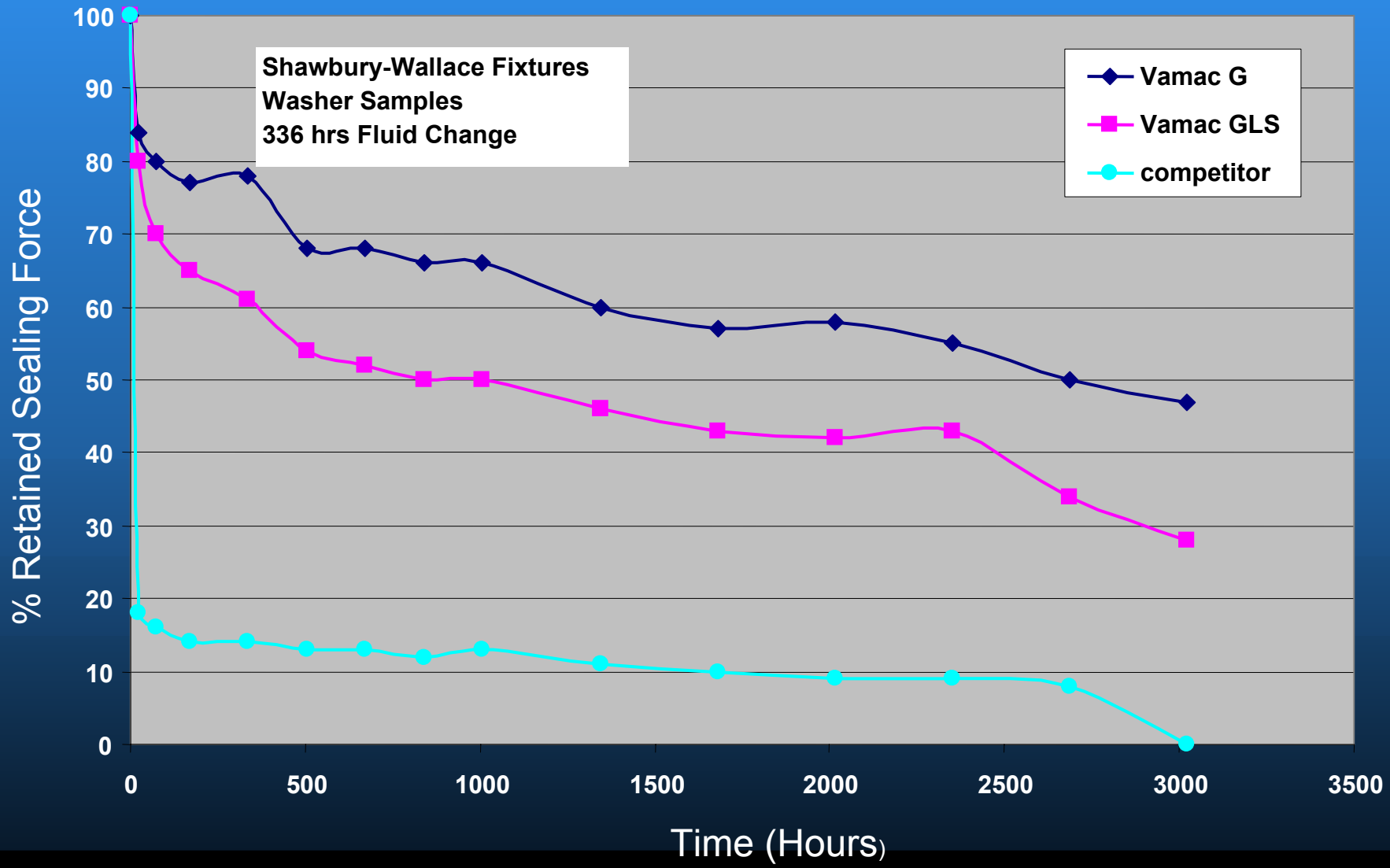


Vamac® G - ASTM Heat Rating



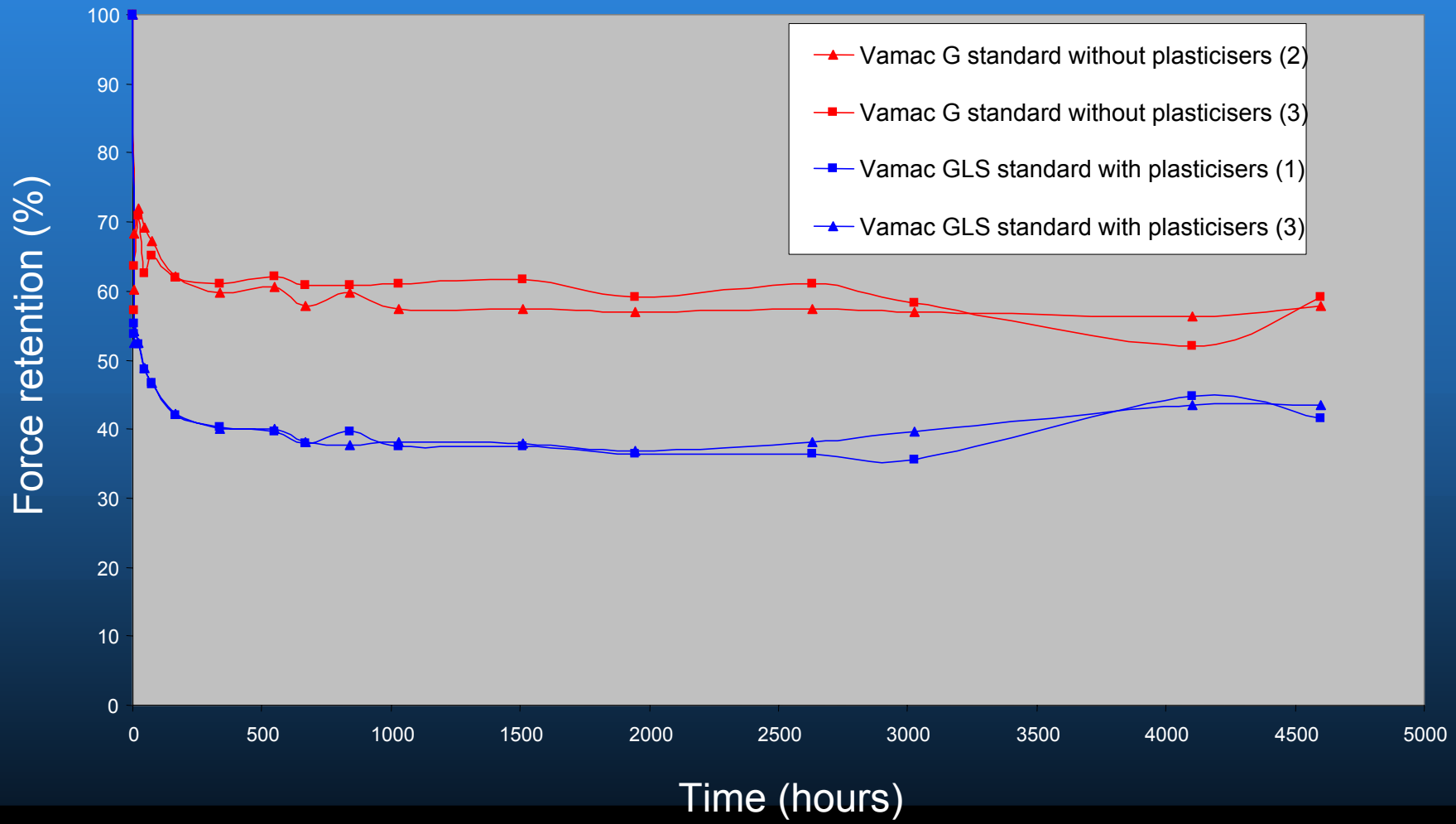
ATTACHMENT 6, 5 OF 18

Vamac® CSR in SF105 @ 150 °C



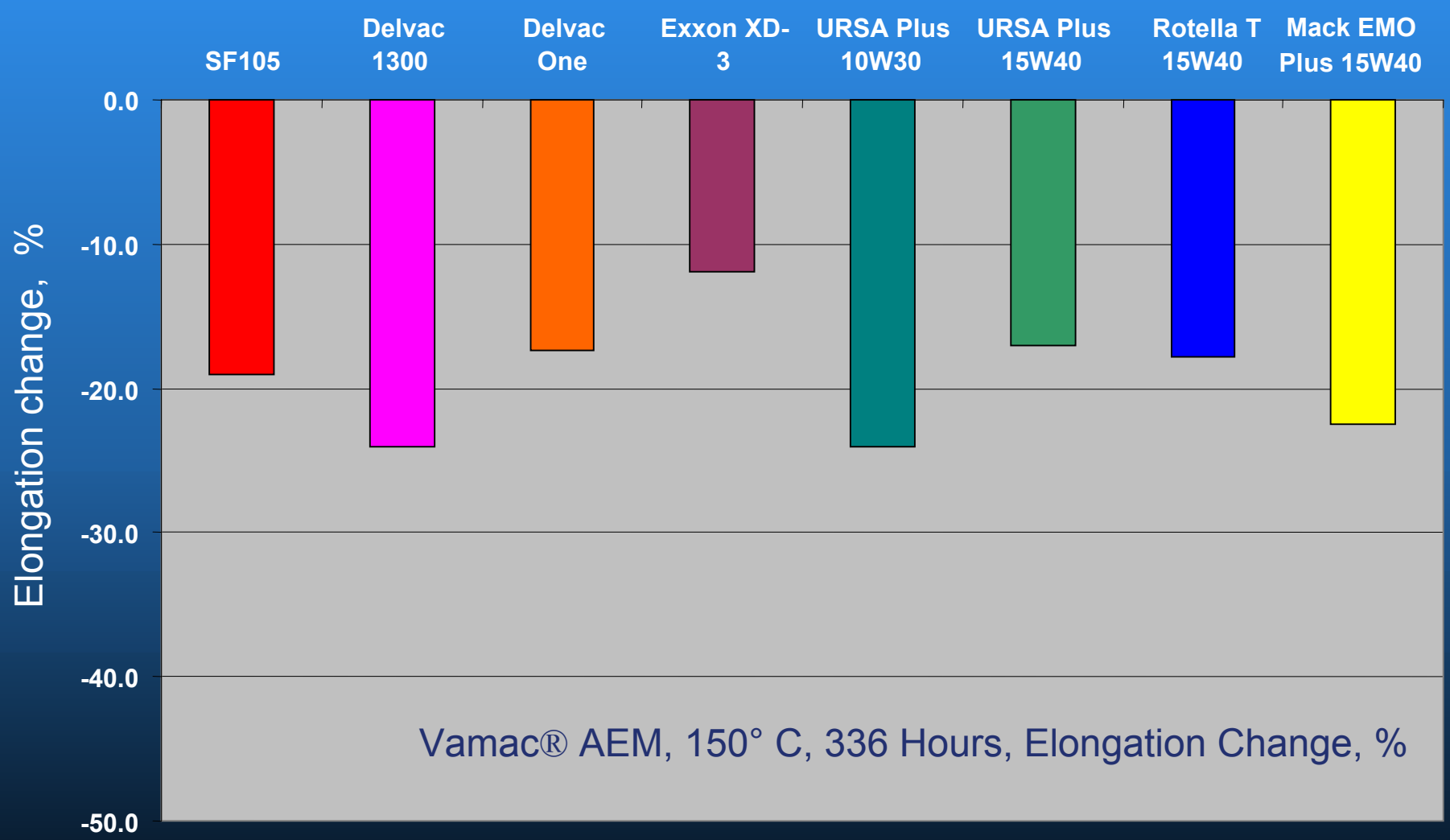
Vamac® CSR Data - Cecilia 20 @ 150 °C

Compressive stress relaxation in Cecillia 20 Oil and Shawbury-Wallace Fixture



ATTACHMENT 6, 7 OF 18

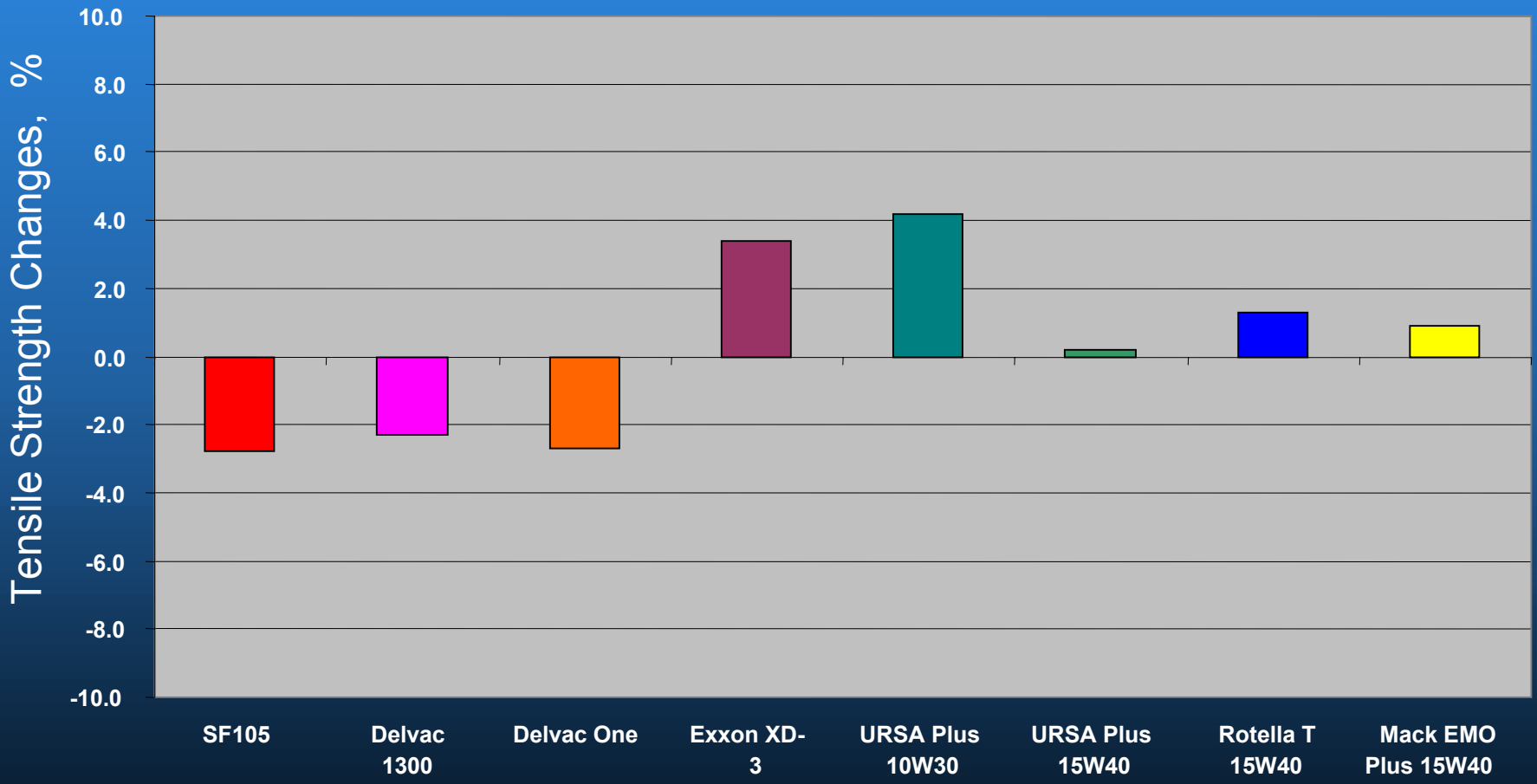
Aging of Vamac® in Diesel Fluids



ATTACHMENT 6, 8 OF 18

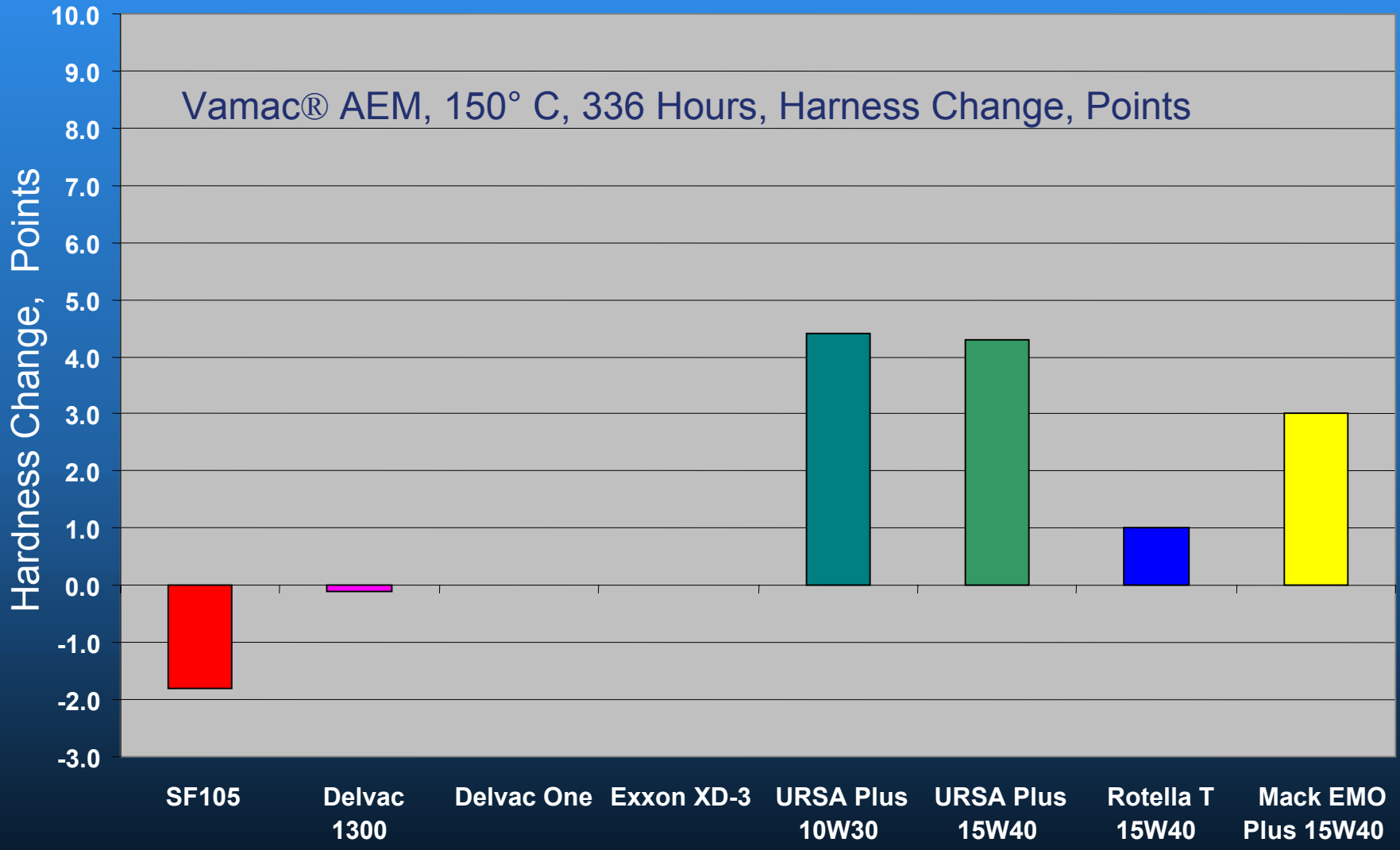
Aging of Vamac® in Diesel Fluids

Vamac® : 150° C, 336 Hours, Tensile Strength Changes, %



ATTACHMENT 6, 9 OF 18

Aging of Vamac® in Diesel Fluids



ATTACHMENT 6, 10 OF 18

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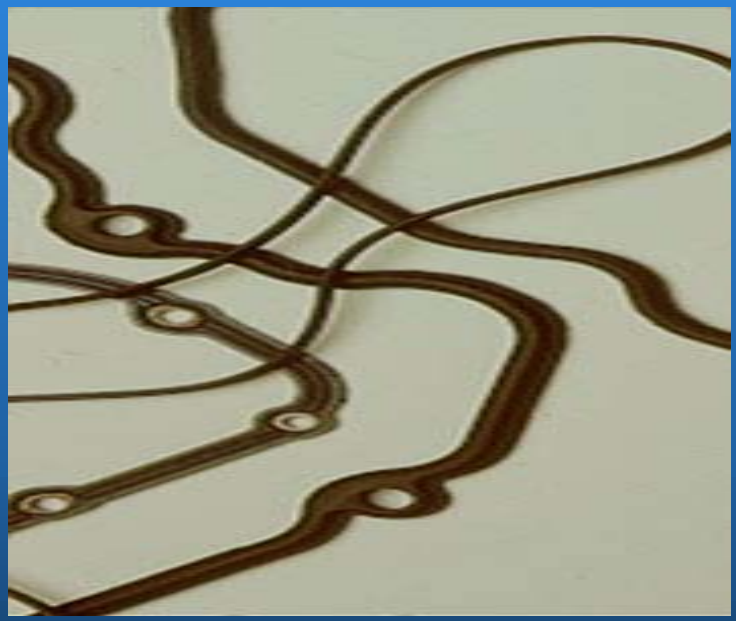
Current Vamac® Applications Relevant to Heavy Duty Diesel

Gaskets and Seals



Engine and transmission pan and cover gaskets in Vamac®

- Heavy Duty Diesel
- Toyota
- Isuzu
- Volvo
- Volkswagen
- BMW
- Renault
- Ford
- Daimler/Chrysler
- GM

Turbo Diesel Hoses

- Volkswagen
- Daimler Benz
- GM - Opel
- Renault
- PSA
- Fiat
- Volvo
- Nissan

Oil Cooler Hose

Volkswagen

BMW

Volvo

Ford

Daimler/Chrysler

Mitsubishi

Honda

Toyota

Crankcase Ventilation Hose

Increasing use because of high temperature and oil resistance

Replacing ECO because of good resistance to acid condensate and combustion by-products

Dampers

- Heavy Duty Diesel
- Volkswagen
- Daimler/Chrysler
- PSA
- BMW
- Toyota
- Honda
- Nissan
- Mitsubishi
- Ford

Summary

Vamac® provides a good balance of heat and fluid resistance at reasonable cost.

Vamac® has excellent long-term heat resistance, dynamic flexibility, and resistance to exposure in mineral and synthetic engine oils, transmission fluids, and Diesel fuels.

As under-the-hood temperature rises and longer service is desired, Vamac® can be a very reliable and cost effective choice for hoses, gaskets, and seals.

The miracles of science™

Heavy Duty Engine Oil Classification Panel

Thank You

Rob French
DuPont Automotive
October 8, 2003

Typical Vamac G

Hardness	65	
		Comment
Vamac® G	100	Polymer
Vamac® GLS		Polymer
Naugard 445	2	Anti-oxidant
Stearic Acid	1.5	Release Package
Vanfre Vam	1	Release Package
Armeen 18D	0.5	Release Package
Carbon Black FEF N-550	60	Filler
TP-759	10	Plasticizer
Diak # 1	1.5	HMDC curative
DOTG	4	Accelerator
TOTAL PHR	**180.5**	

Rheology Properties

Mooney Viscosity		
ML(1+4) @ 100 °C	31.2	
Mooney Scorch@ 121 °C		
Minimum, mu	10.2	
t(3), m.m.	7.64	
t(10), m.m	12.79	
MDR @ 177 °C, 1° Arc		
ML, dN-m (**in-lb**)	0.57	**0.50**
MH, dN-m (**in-lb**)	23.3	**20.5**
ts(2), m.m.	0.90	
tc(10), m.m.	0.90	
tc(50), m.m.	2.61	
tc(90), m.m.	12.2	

Cured Properties

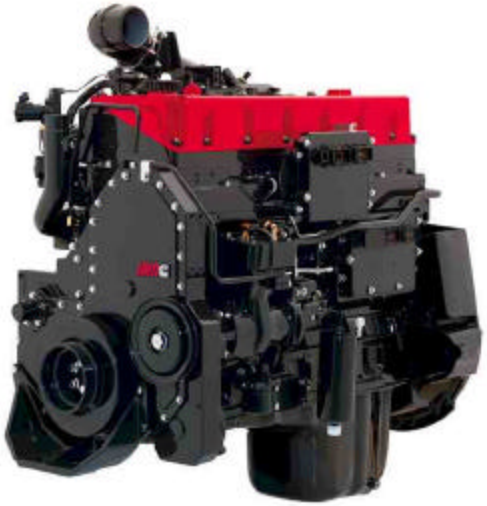
Cure : Press Cure 5 minutes @ 177°C
Post Cure 4 hours @ 175°C

ISM Task Force Report
HDEOCP

Warren Totten

October 8, 2003

Chicago, IL



Scope

- Scope – To develop a lubricant performance test on a Cummins ISM test platform that can discriminate and provide a quality assessment of motor oils in a similar manner as the current M11 test (that includes both the M11 EGR and M11 HST). The ISM test development will consider the following parameters for lubricant quality evaluation:

Primary Parameters	Secondary Parameters
Crosshead weight loss	Liner wear
Top Ring weight loss	Rocker hat weight loss
Injector adjusting screw wt. loss	Push tube scuffing
Sludge	Bearing wear
Oil filter delta P	Intake and Exhaust screws

Objectives

Objectives:

1.	Draft of test procedure	10/3
2.	Finalize matrix plan	10/3
3.	Begin matrix testing	11/03

ISM Test Conditions:

Parameter	Unit	A (Soot)	B (Rated)
Stage Length	H	50	50
Engine Speed	r/min	1800	1600
Torque	N·m (lb·ft)	1300 (960)	1930 (1424)
Fuel Rate	Kg/hr (lb/hr)	58 (128)	64.4 (142)
Intake Manifold Air Temperature	°C (°F)	80 (176)	65.5 (150)
Coolant Out Temperature	°C (°F)	65.5 (150)	65.5 (150)
Oil Gallery Temperature	°C (°F)	115.5 (240)	115.5 (240)

150 hr soot: 5.0% - 6.0%

ATTACHMENT 8, 4 OF 14

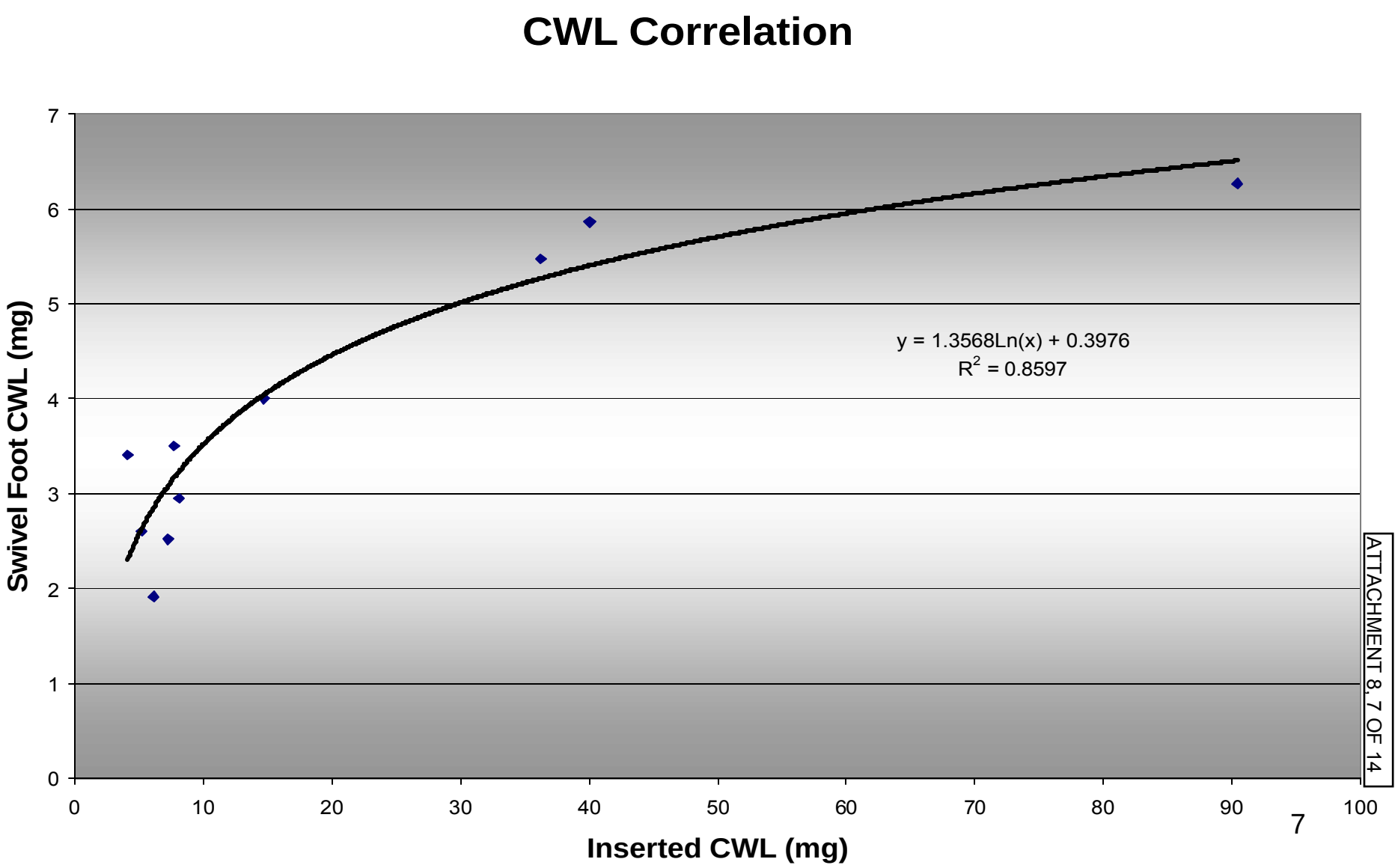
9/5/03 Task Force Mtg. Summary

- ISM test is planned to replace the M11 EGR and M11 HST.
  - The ISM test will have two sets of limits
    - **1 set for alternate pass/fail in the M11 HST**
    - **1 set for alternate pass/fail in the M11 EGR**
- The ISM test is proposed to be 200 hours in length and run on a similar cycle to the M11 EGR test
- Target level soot is 5.0% at 150 hours
- The ISM test will run on 500 ppm S fuel and use double wire screen filters

Comments and Questions

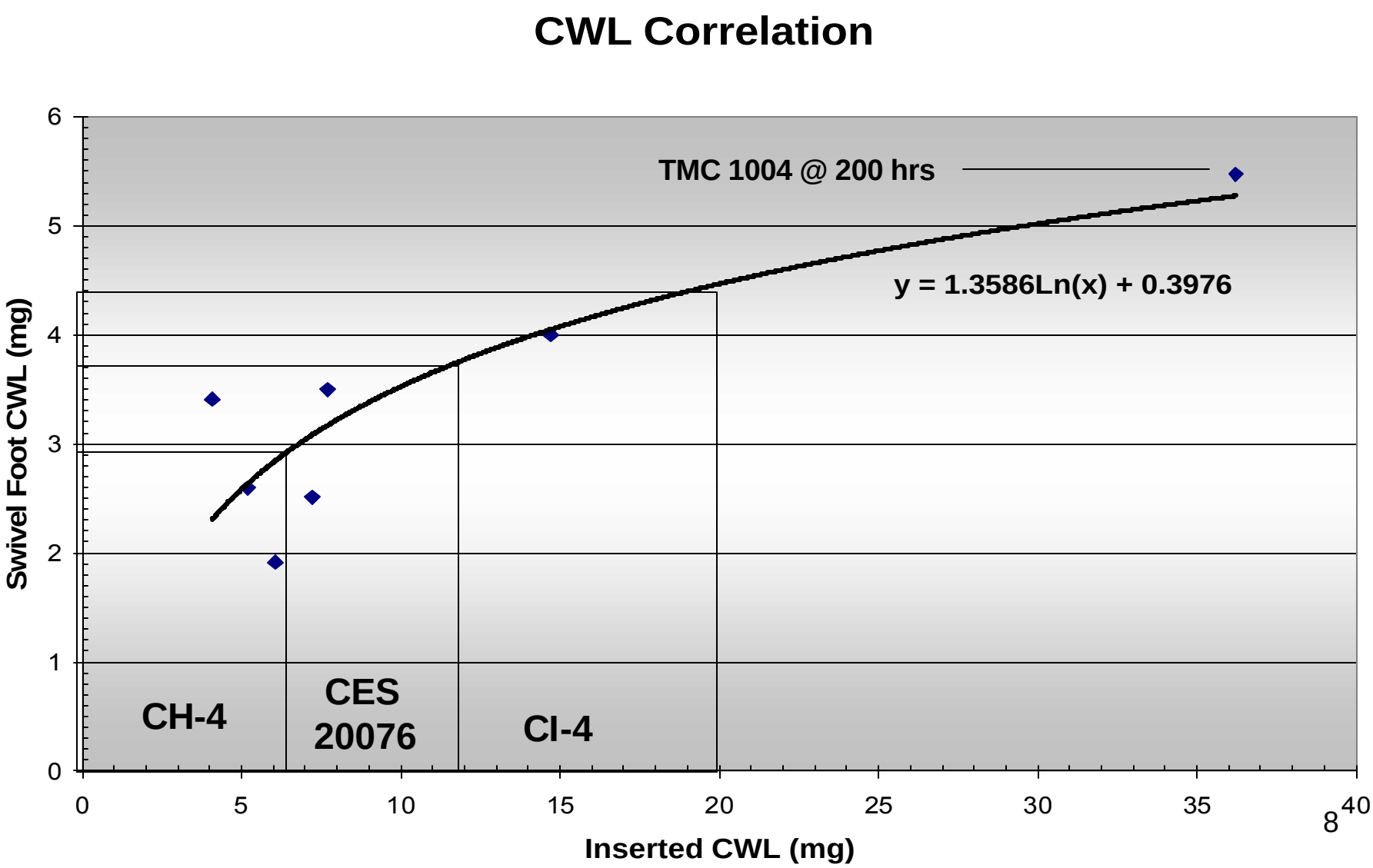
- The ISM test will be carried forward into PC10
- Can the labs get additional rebuild parts for the M11 HST/EGR?
- Does Cummins have any data to share that indicates that the ISM will generate wear?

Swivel Foot Rockers vs Inserted Rockers



ATTACHMENT 8, 7 OF 14

Swivel Foot Rockers vs Inserted Rockers



Proposed Matrix

- Test in Stages
- Use Decision Points
- Use a range of oils
  - TMC 1004, TMC 1005 and TMC 830-2
  - Covers M11 HST and M11 EGR range
- Stage 1
  - First four tests will test two poor oils and two excellent oils in four labs. Cummins will provide funding for parts and fuel for these tests.

Proposed Matrix

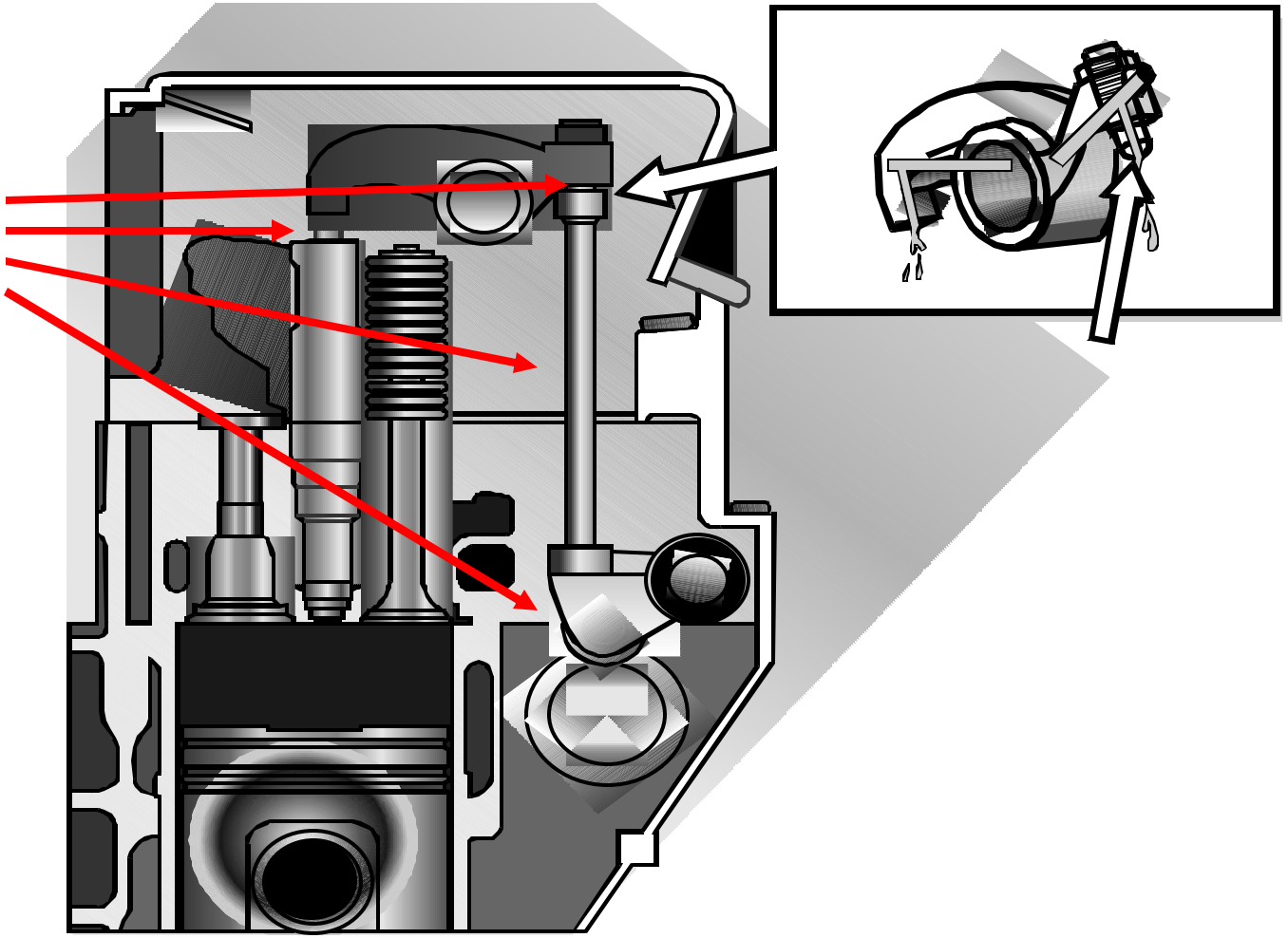
- Is there discrimination?
  - No? Stop the matrix
- Is the discrimination similar to the M11 EGR?
  - No? Stop the matrix
- Stage 2
  - 2 borderline oils and 2 good oils in four labs. Cummins will provide parts for these tests.
- Is the correlation similar to the M11 EGR?
  - No? Stop the matrix
  - Somewhat? Run the reference oil twice in each lab
  - Yes? Run the reference oil once in each lab

Matrix Summary

- Minimum number of tests for a successful matrix: 12 tests
- Maximum number of tests for a successful matrix: 16 tests
- Minimum number of tests for comfort: 4

Injector Adjusting Screw Wear

ISM engine test will also insure good oil performance for other valve train components. This parameter will only be added for PC10 requirements.



*Drawing courtesy of Jim McGeehan, ChevronTexaco (SAE 1999-01-1525)

Injector adjusting screw weight loss

CH4/SJ Oil	CG-4/SJ Oil	CG-4/SJ Oil
21 mg wear	64 mg wear	145 mg wear

*Photo and data courtesy of Jim McGeehan, ChevronTexaco (SAE 1999-01-1525)

Proposals to the TF by OEM

- PROPOSAL: The target be moved to 5.5% - 6.0% to better emulate a 200 hour length M11 EGR test.